Federal Aviation Administration
Acquisition Management System

System Prototypes in Operational Air Traffic Control Facilities: Development and Evaluation Process Guidelines

January 2000

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1.0 Purpose

This document provides a strategy to ensure non-interference with field operations and a structured process to ensure usability and the necessary support requirements are met for developing and evaluating system prototypes in operational air traffic control (ATC) facilities[1]in the National Airspace System (NAS). The goal of this guideline is to ensure that the strategy will not affect the safety of the NAS; the system prototype will not disrupt operational equipment, and the system prototype will not interfere with the duties of facility operations or personnel.

2.0 Policy

All FAA organizations that have authority to plan, direct, control, or contract for a system, or product that will be deployed as a system prototype within the NAS, must ensure the system prototype is documented and supported. This process ensures that the sponsoring organization plan for the entire life cycle, including maintenance and removal of the system prototype, and that the system prototype does not adversely impact the safety of the NAS.

While system prototypes are on their own timeline when they enter AMS (Research, Engineering & Development (R,E&D), MA, IA), the systems or sub-systems in the operational ATC facility are presumably in the In-Service Management (ISM) phase of the AMS and must be treated accordingly.

The FAE via the FAB must approve changes to these guidelines. Board membership and responsibilities are established under the AMS. The FAB may waive the requirements set forth in these guidelines. Any deviation must demonstrate that it will clearly enhance one or more factors (cost, schedule, requirements, or benefits).

All personnel involved in research and development (R&D) activities should use this document as a guideline to request access to NAS data for research, to obtain feedback from air traffic controllers, and for approval of placement of a system prototype or related equipment in operational field facilities.

The Acquisition Management System (AMS) process must be followed for any addition or modification of the NAS architecture. The participating organization(s) will coordinate specific steps that are applicable and recommend modifications to the process through the Federal Acquisition Executive (FAE). This guideline, its attachments and other applicable documents define the system prototype field site development and evaluation process. The processes shall be tailored to each program as appropriate. The responsible Integrated Product Team/Product Team (IPT/PT) lead or sponsor will lead an Federal Aviation Administration (FAA) program review to ensure that the project is properly coordinated. Figure 1 provides a feedback loop to the NAS

[1] Acronyms are listed in Attachment 1.

architecture that allows several places for insertion of system prototypes. The shadowed boxes in Figure 1 indicate where system prototype evaluation is most likely to interface with AMS.

Note that the FAE via the FAE Advisory Board (FAB), indicated in Figure 1, plays a central role in FAA strategic planning as well as the Joint Resources Council (JRC).

R&D programs provide the acquisition process with valuable input. Empirical information from modeling, simulations, tests of R&D system prototypes, and manufacturer tests of commercial off-the-shelf, nondevelopmental item (COTS/NDI) equipment may validate new operational description of concept of use, clarify requirements trade-offs, or verify the benefit of inserting new technology into the NAS. As this information becomes available, it contributes to, and often affects, both mission analysis (MA) and investment analysis (IA). R&D system prototype development and evaluation adheres to the same fundamental paradigms as a full-scale system acquisition: early user involvement, proper planning, sound engineering, rigorous test, and comprehensive analysis.

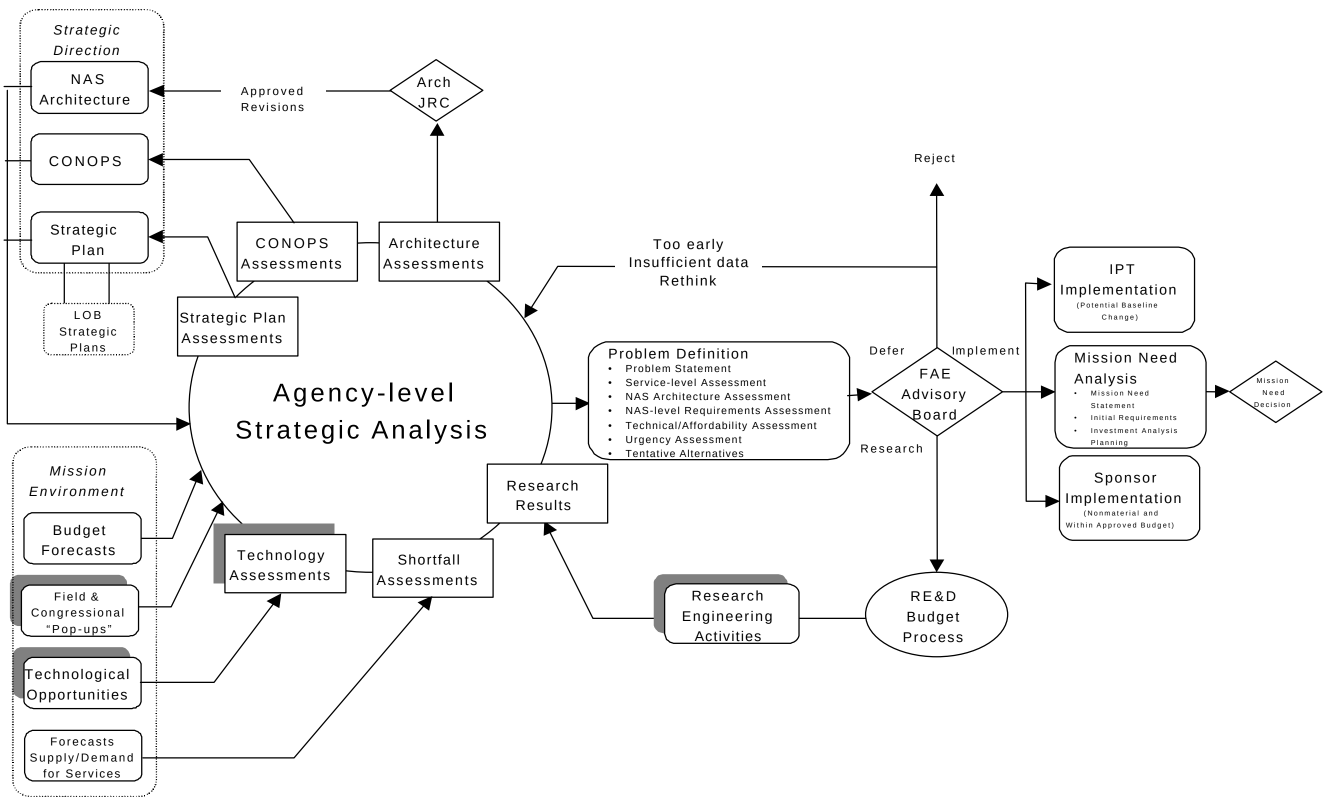

Figure 1 Agency Wide System Analysis Process Flow Indicating Areas That Allow for System Prototype Insertion.

3.0 Background

The FAA uses prototyping activities to assist in assessing alternative solutions to an identified mission need, or as a standard part of the strategic or mission analysis phases of the systems acquisition process. Based on the complexity of the mission need and the alternate solutions proposed, a field assessment of the system prototype solution may be required to support the system definition and acquisition process. Examples of successful system prototype in operational ATC facilities that are currently in transition to operational use include the passive Final Approach Spacing Tool (pFAST), the User Request Evaluation Tool (URET), the Traffic Management Advisor (TMA), and the Integrated Terminal Weather System (ITWS).

4.0 Scope

This guideline shall be used when requesting field support for facilities, people, data, etc., during activities involving system prototyping at operational ATC facilities. ATS is responsible for identifying candidate capabilities and implementation prototypes as well as identifying the FAA implementing organization who will plan and budget for the support service requirements described within the guideline and other applicable documents. This guideline is applicable for the entire time period support is required of a facility. Facility support for the system will end when replaced by a production unit, transition to operations, or removal from the facility.

5.0 Definitions

Fielding of a Prototype: Deployment to assess the stable design using operational data for verification of operational procedures, human factors assessment and validation of logistic support elements (training, shipping, etc.)

In-Service Management Phase: The in-service management phase begins when the new system, software, facility, or service goes into operational use, and continues for as long as the product is in use. A continuing partnership among the providing, operating, and support organizations participating on Integrated Product Development System (IPDS) teams characterize this phase.

Investment Analysis Phase: Investment analysis generates the information used by the Joint Resources Council at the investment decision to determine the best overall solution for satisfying a mission need. It is conducted as a partnership between the sponsoring and acquiring organizations to ensure the critical needs of the user and customer are satisfied by an affordable solution.

Mission Analysis Phase: Mission analysis is a strong, forward-looking, and continuous analytical activity that evaluates the capacity of agency assets to satisfy existing and emerging demands for services. Mission analysis enables the agency to determine and prioritize its most critical capability shortfalls and best technological opportunities for improving the FAA's overall safety, security, capacity, efficiency, and effectiveness in providing services to its customers.

Production System: An operational product, functionality, or system that has successfully gone through the AMS planning, budgeting, approval, development, testing, and certification processes.

Prototype Concept Development: The development of a concept to evaluate its potential to fully satisfy key needs or issues, derive functional characteristics, and expected benefits. Concept development for a specific system prototype is deemed complete when the following objectives are realized:

a) The initial concept of operation has been approved by the FAB,
b) All major technical and operational issues have been identified and,
c) Costs for continued development and implementation have also been estimated.
d) An initial concept of use has been developed to describe how operational personnel will use the system prototype for a desirable capability for NAS users.

Prototype Demonstration: An examination of the "as-built" design developed to determine its feasibility for fielding at an ATC facility. The prototype demonstration begins when the software module or hardware has been assembled and is ready for laboratory tests and demonstration. Alternative concepts may be under simultaneous evaluation, and preliminary research results may eliminate some of them. Criteria for advancing a proposed decision support tool from the concept exploration may include:

a) Installation and supporting methodologies, and
b) The impact to the field has been defined in terms of safety, human factors, procedures, and performance.

Prototype Developer: The organization (either internal or external to the FAA) performing the research and development necessary to meet the need of the sponsoring organization.

Prototype Development: The development of a functional system prototype version of the proposed product to identify and evaluate design features, identify and resolve development risks, and identify potential integration and compatibility issues. A project will proceed from this phase to full-scale development when such a course is justified and approved through the FAA's capital investment and system acquisition process.

Prototype Implementer: The system prototype implementer is responsible for ensuring that all life cycle requirements are adequately planned, budgeted, and executed for the development, fielding, maintenance, and removal of the system prototype.

Prototype Maintainer: The organization(s) responsible for supporting the operation and maintenance of the system prototype.

Prototype Sponsor/Customer: The office or service having a need to be met through the development and fielding of a system prototype or service in the en route and/or terminal environment.

Solution Implementation Phase: Solution implementation begins after the JRC selects a solution and establishes an acquisition program. It ends when a new capability goes into service.

System Prototype: An original type, form, or instance that serves as a model on which later stages are based or judged. In the present context of research and development it generally refers to a concept, functionality or system deployed to enhance a capability at an operational FAA field facility, or to enable further development and assessment prior to a JRC meeting, which establishes a formal implementation program within the AMS.

6.0 Prototype Insertion Process

The AMS has five phases, which a program or system must transition through during its life cycle. These phases are MA, IA, Solution Implementation (SI), ISM, and Service Life Extension. It is unlikely that a prototype will be used to extend a system's service life, so the Service Life Extension phase will not be addressed. This section defines the relationships and decision points for the other four phases as they relate to prototypes. This process is the prime means of controlling requirements, quality, and cost. (Figure 2)

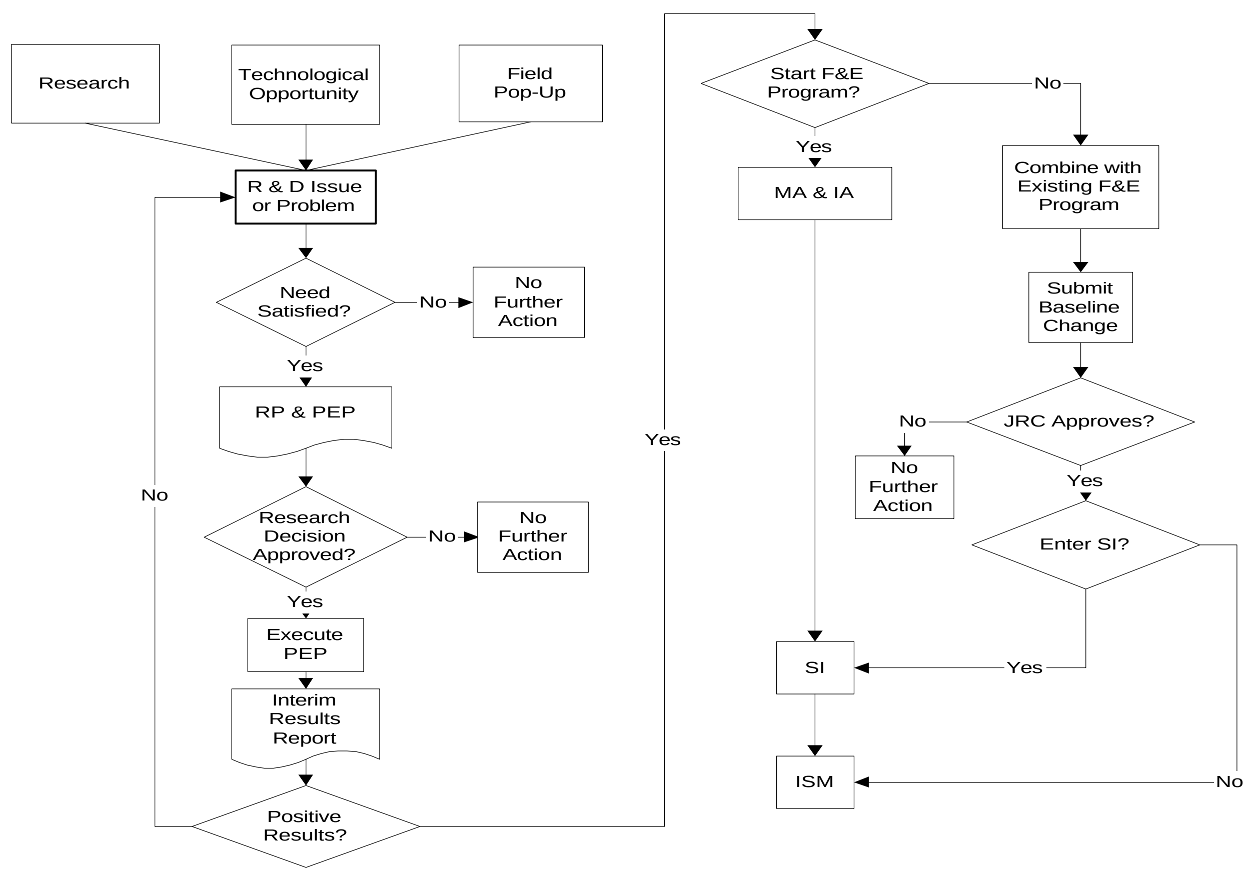

Figure 2. Process Flow Diagram of System Prototypes.

The three general types or groupings of prototypes that enter the process identified in Figure 2 and are described below are summarized in Table 1. The first and most traditional is the research type. In this case a research issue or problem is identified and documented in a research project description (RPD). Discussion occurs between the originator and others stakeholders to determine if an RPD shall be forwarded for evaluation. If the RPD is deemed to have merit in meeting the FAA mission requirements a Research Plan (RP) and a Prototype Evaluation Plan (PEP) are prepared for the research decision. After the designated executive or advisory board accepts the RP, a designated IPT or prototype developer implements the PEP. The PEP must show points of management review where the overall progress of the prototype can be assessed based on metrics identified in the PEP. Table 1 highlights two decision points: a request to build a system prototype, and a request to provide access to field facilities. The IPT or prototype developer successfully complete all exit criteria identifies in the PEP in order to continue the development process. At a minimum, the interim results must ensure that the concept scenario and functional characteristic, as originally described or modified, have met the objective(s). The FAE or designated decision-maker then determines if the system has wider applicability and a strategy is prepared which transitions the system prototype into an AMS viable program. (See Figure 2.)

<table>
<tr><th>Phase</th><th>Research</th><th>Technological Opportunity</th><th>Field Pop-Up</th></tr>
<tr><td>Concept Development</td><td>Originator identifies problem
Problem documented and agreed upon
RPD prepared
RP prepared
PEP prepared
Research DECISION
Prototype activities start
Operational scenarios developed
Develop prototype requirements
Develop functional characteristics
DECISION to build a system prototype</td><td>Note that this is usually paid for out of non-AMS related funds</td><td rowspan="2">A continuation of the Research and Technological Opportunity models shown at the left. FAA needs documentation of changes (NCP formal or informal). NCP will cover their initial change(s)</td></tr>
<tr><td>Build System Prototype</td><td>1. Allocate functions to HW and SW
2. Request data from FAA site
3. Start SW coding
4. Start assessing HW
5. Conduct initial demonstration</td><td rowspan="2">Manufacturer or laboratory has already built the product. Before the investigation/assessment starts FAA needs:
1. Description of item, component, avionics, SW module, or type of black box
2. Functional characteristics
3. Concept of operation
4. DECISION to use FAA laboratory or FAA field site

Research or IA DECISION</td></tr>
<tr><td>Prototype Demonstration</td><td>Simulation or modeling
Continually mature prototype

DECISION to provide access to FAA field facilities</td><td>RPD , RP, and PEP prepared and assigned to laboratory or contractor
Only national changes are presented to FAB
Once accepted by FAB –

Research DECISION</td></tr>
<tr><td>Field at FAA Facilities</td><td>Prepare prototype for site delivery for initial testing
Identify site needs (people, space, data, connectivity)

Prepare exit brief
Transition to an AMS activity
Make recommendation
New start F&E program
Combine/modify existing F&E program
Cancel did not meet research goals
Segment research
Refine research objectives</td><td>IPT/PT for Lab decide on field site
Prepare PEP
Identify site needs (people, space, data, connectivity)

Prepare exit brief
Transition to an AMS activity
Make recommendation
New start F&E program
Combine/modify existing F&E program
Cancel did not meet research goals
Segment research
Refine research objectives</td><td>Laboratory or contractor will produce a prototype model
Original FAA field site becomes host for field site demonstration

Transition to an AMS activity
Make recommendation
New start F&E program
Combine/modify existing F&E program
Cancel did not meet research goals
Segment research
Refine research objectives</td></tr>
</table>

Table 1. Prototype Process Life Cycle.

The Technological Opportunity box depicted in Figure 2 is further described in Table 1. This applies to technological assessment and technological demonstrations. These activities normally occur in the IA, SI, and ISM phase of AMS. This prototype activity is characteristic of a mature prototype or a commercial off the shelf system (COTS). It can reasonably be assumed, in many cases, that the early concept development work took place outside of normal AMS funding. To transition this type of activity into the AMS a developer must document a technology with sufficient data to support a decision for further development. This can be accomplished by using an RPD or PEP. If the technology demonstration is part of a competitive procurement, then the requirements and concepts will be addressed in the request- for-information or request-for-offers. After completion of the RPD and RP, the designated FAA office or IPT prepares for the Research Decision or IA Decision. If the COTS system meets requirements it continues in the AMS process. In the event that the COTS system is not ready, then the AMS entry point is the same as one in research prototypes, ‘build system prototype’ (see Table 1), indicating that additional design or interface issues must be evaluated.

The Field Pop-Up box depicted in Figure 2 is further described in Table 1. This system is normally in ISM. The system or equipment has been operational for some time at one location and the user is familiar with range of design functions the system possesses. This concept or idea developed from a local need to improve a process or service. If productivity or efficiency gains that apply to a wider range of NAS service providers then it is now ready for the AMS decision process. The technology, which evolved out of an informal or site specific activity, must now under go basic configuration management. It is important to note that changes to baseline hardware or software shall not begin until a NAS Change Proposal (NCP) has been approved. A decision to change the NAS architecture to incorporate the technology is made at this time. A national or limited regional deployment decision is assigned to a lead office or facility for final development. The ‘field pop-up’ has one decision point, which is the Research Decision.

7.0 Use of Existing Laboratories

Prior to reaching the field site, the candidate system shall have undergone extensive simulation testing and evaluation. The FAA has an established process and methodology for testing and evaluation of system prototypes prior to deployment into operational field facilities. There are numerous laboratories and research facilities available to the FAA. Prototyping is essential to avoid past problems of entering into large-scale acquisitions without validated requirements and without a mechanism for learning and requirement validation. Successful application depends on deep knowledge of ATC, related systems, and past and related developmental activities. In specific areas, the various simulation laboratories and research facilities are in a special position to combine the process of prototyping with required application knowledge. This is, in fact, a fundamental attribute and benefit of having prototyping work completed prior to insertion into an operational ATC facility.

Brief descriptions and capabilities for a number of laboratories are described in Attachment 6.

8.0 Field Evaluation of System Prototypes

Generic checklists for different types of acquisitions are available from FAST, and shall be tailored for specific programs. When programs require the fielding of operational system prototypes, the program office must plan and coordinate with the FAB to obtain support for fielded equipment so long as it remains operational. This support typically includes such items as training, operator and maintenance manuals, repair parts and services, and maintenance. Specifically, a sponsor's team is responsible for conducting a review process to ensure the readiness of the system prototype and the readiness of the NAS infrastructure to accept, operate, and maintain the system prototype. The program office must assure the removal of all related equipment and ensure that the site is restored to its prior condition when the field demonstration is complete. Should the system prototype remain in operation until a production system is installed, the system prototype must be removed from the site when the production system becomes operational.

If a system prototype is to transition to operational service, an in-service review (ISR) must be conducted to ensure that operational and support requirements are in place for the life of the system. A representative from each affected organization will be empowered to make the appropriate decisions for the life cycle of the system prototype, and ensure the intent of these guidelines are enforced.

8.1 Documentation[2]

A subset of the documentation needed for an operational system must be provided prior to fielding the system prototype. The required documentation is as follows.

8.1.1 Research Plan (RP)

A template for the Research Plan is included in Attachment 3. The Research Plan contains the strategy, research evaluation criteria, goals, must evaluators (Air Traffic Services (ATS) will assign evaluators in appropriate organizations, such as: Independent Operational Testing and Evaluation (ATQ), Operational Support Service (AOS), William J. Hughes Technical Center, (ACT), and System Architecture and Investment Analysis (ASD), exit criteria, and cost.

8.1.2 R,E&D Project Description (RPD)

An RPD contains a description of the project, accomplishments, schedule and a five-year budget projection. A RPD template is found in Attachment 4.

8.1.3 Prototype Evaluation Plan (PEP)

A PEP is needed to guide the development of a system prototype and identify how the system prototype would be used to validate the proposed system. Consistent with the NAS architecture, a PEP will include a detailed description of the system prototype, as well as the strategy for

[2] A Summary of Documentation Requirements is found in Attachment 2.

testing the operational, technical and economic value of the system. To address these elements, a PEP must follow the intent of the AMS process to ensure successful system prototypes can be included in the NAS architecture. A PEP template is found in Attachment 5.

8.2 IPT/PT Lead/Sponsor Responsibilities

The IPT/PT lead or sponsor is responsible for complying with and applying the provisions of this guideline and other applicable documents to the extent possible. A Memorandum of Agreement (MOA) between prototype developers and the IPT/PT lead or sponsor must define roles and responsibilities for both the prototype developer and AT/AF regarding operational use, maintenance, support, etc. This shall include to the AOS division(s) responsible for existing NAS systems and must be completed prior to prototype installation at operational facilities. Under the provisions of this guideline, leads and developers shall:

1. Ensure the AMS readiness checklist is used for a variety of pre-readiness events as part of the responsibilities, authority, and accountability for a data request for a system prototype. In particular, ensure that checklist items are included in the specific milestones.
2. Initiate, conduct, and complete a thorough and objective project readiness review.
3. Establish and maintain current milestones that are key to scheduling events. (e.g., all support requests submitted, systems delivered to the test and evaluation (T&E) sites, and systems delivered to operational sites). Status reports shall be delivered to the project sponsor.
4. Ensure prompt closure of open checklist items assigned to the project in accordance with the action plans and established dates and milestones.
5. Provide a briefing to the applicable ATC facility manager and other appropriate facility personnel approximately 30 days before the entry into an ATC facility. This is to ensure that no issue has been overlooked and that all parties agree on the action plans.
6. Continually report results to the program sponsor.

8.3 Communications

Inter/intra-facility communications support will normally be required to collect data or install and test a system prototype. Planning, budgeting, coordination and proper approvals are required to ensure appropriate resources and services are available when needed.

The transition of a system prototype to daily operations requires appropriate life cycle support requirements and documentation to be planned and budgeted for in advance of the planned transition. This requirement directly supports the Airway Facilities (AF) capability to provide operational life cycle support for the system. For any system prototype, specific entry and exit timing and procedures must be documented and made known to the facility.

8.4 Test and Evaluation

For a system prototype, a test program must be defined prior to implementation or deployment. A structured T&E program (such as the T&E Gold Standard Process) must be followed successfully completed, and the results documented prior to integration into the NAS. This testing shall be completed at the FAA William J. Hughes Technical Center (WJHTC) when possible, or at least have WJHTC personnel support. Testing shall include but is not limited to:

1. Non-interference testing of the interface device (e.g., HOST/HOCSR, DSR, STARS, ARTS, etc.), operational and support software and system.
2. Functionality testing of the operational and support software and systems.
3. Performance testing of the operational and support software and the systems.
4. Interface integrity verification between the system prototype and NAS subsystems.

If changes are made to the above-mentioned testing/evaluation, then regression testing will be performed prior to the fielding of the new software or hardware.

8.5 Safety

System prototype activities are subject to environmental and occupational safety (including system safety), and energy management statutes, regulations, executive orders, and presidential memoranda. Key considerations are pollution prevention, safety and health, cultural and natural resource conservation, public participation where applicable, and energy and water conservation. Safety factors including human machine interface (HMI) and environmental safety are critical aspects of aviation safety and effectiveness. The deployment of system prototype equipment must include human factors and environmental engineering considerations.

8.6 Security

The FAA must conform to national policy related to the physical security of the aviation infrastructure, and the security of all information associated with operation of the agency and aircraft. The FAA is also obligated to protect proprietary information to which it has access. Physical security is directly applicable to aviation industry operations and activities, and to supporting infrastructure such as communications, sensors, and information processing.
The IPT/PT lead or sponsor must submit a Physical and/or Information System Security (ISS) plan. This plan must be coordinated with the chief information officer (CIO) prior to fielding the system. The system prototype must provide ISS functionality and assurances to ensure:

1. That all data processed by the system are protected at all times in accordance with the data sensitivity requirements,
2. That access to the system prototype, for both operations and maintenance functions, is restricted to authorized personnel, and
3. That ISS auditing functions are sufficient to provide accountability for all accesses and attempted accesses by users. A strategy must be developed for coordinating ISS measures with those for existing physical, environmental, and personnel security (including any measures for contractor-unique security), or to provide these measures if they do not currently exist.

8.7 Support Software

All changes to NAS operational software for system prototypes must be analyzed for impact to support software by AOS. Coordination must occur between the prototype developer and the AOS division(s) responsible for the existing NAS system(s) that interface with the prototype. This is essential to ensure that prototypes do not degrade existing NAS performance and maintainability. In addition, support tools shall be identified and procured to assist in the maintenance of the system prototype. These tools may include compilers, debuggers, build development packages, and other configuration management tools.

8.8 Training

In order for a system prototype to be used at an operational facility, training must be provided to the appropriate personnel (AAT/Airway Facilities Service (AAF)/AOS) who will be operating, supporting, or monitoring the activity of the system prototype.

The training requirements, roles and responsibilities for AAT and AAF at the operational facilities must also be determined. Training requirements will be addressed in the RP and the PEP.

8.9 Configuration Management

Any system prototype approved for field deployment shall be maintained under a Configuration Control Board (CCB) management process. The members of the CCB will be the developers of the system, the test organization, AOS, and others as applicable. The members will approve all changes to the system prior to fielding or testing. For system prototyping, once changes are complete, the system will be regression tested as required, and as described in the testing section of this document.

When an R&D project produces an improvement or an additional functional capability that is deemed to be of immediate benefit to the NAS, it may be a candidate for a rapid deployment. The AMS process provides the guidelines for rapid deployment decisions.

Attachment 1: List of Acronyms

AACE	Airworthiness Assurance Center of Excellence
AAF	Airway Facilities Service
AAR	Office of Aviation Research
AAT	Air Traffic Services?
ACT	William J. Hughes Technical Center
AMS	Acquisition Management System
AOS	Operational Support Service
Arch	NAS Architecture
ARTCC	Air Route Traffic Control Center
ARTS	Advanced Radar Terminal System
ASD	System Architecture and Investment Analysis
ATC	air traffic control
ATM	air traffic management
ATQ	Independent Operational Test and Evaluation
ATS	Air Traffic Services
CAASD	Center for Advanced Aviation Systems Development
CCB	Configuration Control Board
CIO	chief information officer
CM	configuration management
CONOPS	concepts of operation
COTS/NDI	commercial off-the-shelf, nondevelopmental item
CTAS	Center/TRACON Automation System
DOT	U.S. Department of Transportation
DSR	display system replacement
ERAU	Embry-Riddle Aeronautical University
F&E	facilities and equipment
FAA	Federal Aviation Administration
FAB	FAE Advisory Board
FAE	FAA Acquisition Executive
FAST	FAA Acquisition System Toolset
FFRDC	Federally Funded Research and Development Corporation
FSD	full-scale development
HMI	human machine interface
HOCSR	Host/Oceanic Computer System Replacement
HOST	host computer
HVAC	heating, ventilation and air conditioning
IA	investment analysis
IAIPT	Interagency Air Traffic Management Integration Product Team
IPDS	Integrated Product Development System
IPT	Integrated Product Team
ISM	In-Service Management
ISR	in-service review
ISS	information system security
ITWS	Integrated Terminal Weather System

JRC	Joint Resources Council
JUP	Joint University Program
MA	mission analysis
MIT	Massachusetts Institute of Technology
MITRE	the Mitre Corporation
MMAC	Mike Monroney Aeronautical Center
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAILS	National Airspace Integrated Logistics Support
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NCP	NAS Change Proposal
OT&E	operational, test & evaluation
pFAST	passive Final Approach Spacing Tool
PEP	Prototype Evaluation Plan
PT	Product Team
QA	quality assurance
R&D	research and development
R,E&D	research, engineering, and development
RP	Research Plan
RPD	Research Project Description
RSPA	Research and Special Programs Administration
SI	Solution Implementation
STARS	Standard Terminal Automation Replacement System
T&E	test and evaluation
TFM	traffic flow management
TMA	Traffic Management Advisor
TRACON	Terminal Radar Approach Control
URET	User Request Evaluation Tool
WJHTC	William J. Hughes Technical Center

Attachment 2: Summary of Documentation Requirements

FAA Acquisition Management System Phase			
Mission Analysis	Investment Analysis & Solution Implementation	Solution Implementation and In-Service Management	In-Service Management
RPD ([1])	updated RPD		
RP ([2])	updated RP		RP
PEP ([3])	updated PEP	updated PEP	updated PEP
Interim Results Report	Interim Results Report		
		Field Support Plan	Field Support Plan
		Test Plan	Test Plan

[1] See Attachment 4.
[2] See Attachment 3.
[3] See Attachment 5.

Attachment 3: Template for Research Plan (RP)

1. Goals
2 Strategy (Explain the relationship to FAA organizational and strategic goals.)
3. Description of Research
   3.1 Problem Definition
   3.2 Operational Concept
4. Cost
5. Metrics (Exit Criteria)

Attachment 4: Template for Research Project Description (RPD)

Federal Aviation Administration
Office of Aviation Research
Research Project Description

-ABSTRACT-

RPD Name
Date Submitted:
Target Area:

1. Research Project Title:
2. Research Project Number:
3. Date:
5. Research Initiative:
6. Research Manager:
7. Sponsoring Organization:
8. Sponsor Priority:
9. Desired FAA Outcome:
10. Expected FAA Output:
11. Project Performance Goal:
12. Project Performance Measure:
13. Project Contract Costs:
14. Key Products and Milestones:
15. Project Benefits:
16. Accomplishments:
17. Program Drivers:

Note: There is also a Supplemental Data Sheet that may have to be supplied.

Attachment 5: Template for Prototype Evaluation Plan (PEP)

Title Page
Signature Page
ATO at a minimum will sign.

1. Background (Purpose, scope)
   Identify how the system prototype will be used. Include a detailed description of the system prototype in an operational scenario.
2. Entrance Criteria
   Briefly describe what must be in place before bringing the system prototype into an operational ATC facility. Describe the field support needs including personnel such as controllers, AT staff and AF personnel.
3. Installation

   3.1 Site Configuration
   Detail the activities, schedule, and responsible organization(s) involved in installing the system prototype. Identify the equipment (with details concerning ownership) to be located at the facility, location/configuration of the equipment at the facility, and details on all connections into the NAS.

   3.2 Hardware Interfaces
   Describe in detail the required interfaces for the hardware components.

   3.3 Software Interfaces
   Describe in detail the required interfaces for the software modules.
4. Training
   Detail who, what, when, where, and how long the training will be performed.
5. Test and Evaluation

   5.1 Schedule
   5.2 Data Collection, Reduction, & Analysis
   Describe the method(s) to be used at the facility.
   5.3 Evaluation
   Evaluate the results to see when sufficient data are collected to prove or disprove the system prototype.
6. Maintenance
   Detail the maintenance strategy for the life cycle of the system prototype and the responsible organization(s).
7. Exit criteria
   Detail at what point and how the system prototype will be removed from the facility. Identify architectural issues and any NAS documentation that is affected.

Attachment 6: List of Laboratories

Laboratory	Discussion
FAA William J. Hughes Technical Center (WJHTC)	The WJHTC has superb test and simulation facilities, experienced test personnel, and a corporate memory of FAA testing. All ATC domains or environments can be tested independently, or in unison, in very high-fidelity simulations. Test at WJHTC instead of at the developer's facilities when realistic operational environments and/or interfaces to other NAS Systems are necessary to insure operational suitability. Beginning operational tests at WJHTC will minimize test disruptions to site operations. URL http://www.tc.faa.gov/ **Airway Facilities Tower Integration Laboratory (AFTIL)** FAA W. J. Hughes Technical Center Atlantic City International Airport, NJ 08405 The Airway Facilities Tower Integration Laboratory (AFTIL), established and sponsored by ANS-240, is located at the FAA William J. Hughes Technical Center in Building 170. The AFTIL is a state-of-the-art air traffic control laboratory that provides a realistic, flexible, and controlled Airport Traffic Control Tower (ATCT) environment for the analysis of transition and implementation issues. The AFTIL's authentic tower cab environment is created by integrating actual floor plans, console mock-ups, functional and simulated tower equipment and interfaces, and an Out-the-Window Display System (OWDS) and airport traffic simulation system, into a realistic representation of a tower cab. The AFTIL contains a full setup of ATCT cab facilities, controller workstations, display equipment, and related hardware and system software.
Embry-Riddle Aeronautical University (ERAU)	ERAU's modeling and simulation tool set consists of leading-edge modeling software and fully capable simulators where experiments may be conducted in search of solutions to a myriad of airspace or airport issues and questions. From changes in en route or terminal airspace design; to airport runway, taxiway and gate configurations; to airline scheduling practices; the ERAU tool set is specifically designed to address these and many other research questions. URL http://www.ERAU.edu/
Joint University Program (JUP)	Through the JUP, university principal investigators explore new and important areas of aeronautical technology. By focusing on critical issues of air transportation, by emphasizing coordinated, individual efforts of students and their professors, by building on the complementary strengths of the three university research groups, and by providing long-term continuity of support, program participants develop perspectives about aeronautical problems and their solutions. The JUP consist of Massachusetts Institute of Technology (MIT) - Lincoln Laboratory, Ohio University, and Princeton University
Mike Monroney Aeronautical Center (MMAC)	MMAC is the agency's principal source of aviation technical training. Over 30,000 students are trained at the FAA Academy in 1,300+ courses including resident, computer-based instruction, interactive video teletraining, correspondence study, and field delivered training. URL http://www.mmac.jccbi.gov/MMAC/

Laboratory	Discussion
MIT Lincoln Laboratory	MIT Lincoln Laboratory is a part of the JUP. The Lincoln Laboratory research approach emphasizes following a project from the concept stage, through simulation and analysis, to the development of hardware and the ultimate demonstration of an integrated system. The Laboratory's environment of dedicated people, in well-equipped state-of-the-art facilities, motivates excellence and innovation. URL http://www.ll.mit.edu
MITRE Center for Advanced Aviation Systems Development (CAASD)	The FAA's Federally Funded Research and Development Corporation (FFRDC), the CAASD, has a multitude of simulation laboratories and research facilities available to support a variety of activities throughout the life cycle of both R,E&D and F&E programs. Prototyping capabilities allow the FAA and the aviation community to evaluate new concepts, to validate requirements for new functions, to resolve performance and human factors issues, and to influence the standards development processes. Operated by The MITRE Corporation, CAASD conducts essential engineering, architecture, systems and operations analysis and technology development activities to help the FAA plan, acquire, and implement its future ATM systems. URL http://www.caasd.org/
NASA Ames Research Center, NASA Langley Research Center, NASA Lewis Research Center	The Aviation System Capacity program works closely with the FAA, the airlines and the manufacturers - the technology customers - who are responsible for applying the candidate research and development products as operational systems. In the area of ATM research and development, a NASA/FAA Inter-Agency Integrated Product Team is responsible for the strategic management of this area of, assuring that the efforts of both agencies are conducted to maximize the benefits of the research. The Team reports to a NASA/FAA Executive Council, comprised of the appropriate Associate Administrators from both Agencies. NASA and the FAA have an integrated research and technology development plan, approved by both the NASA Associate Administrator for Aero-Space Technology and the FAA Associate Administrator for Research and Acquisition. Each agency is responsible for the conduct of its programs. URL http://www.arc.nasa.gov/
Northwestern University	Northwestern University and the Transportation Center are among the governing core members of the FAA's new Airworthiness Assurance Center of Excellence (AACE). Over the next several years, the AACE will be the FAA's principal vehicle for identifying and funding research on aircraft structural safety issues, including critical maintenance practices for the large number of aging aircraft in the world fleet. Advanced technologies will be a key factor in maintaining the United States' competitiveness in the global production and operation of aviation systems, and in the reduction of aviation accidents. Northwestern works in concert with other members of the JUP. URL: http://www.nwu.edu/

Laboratory	Discussion
Ohio University	Ohio university through the JUP materially improves the efficiency, performance, and safety of air transportation in the United States by identifying promising targets for development, by conducting associated long-term research, and by educating technological leaders. Approach • Involve leading academic researchers and their students in solving aeronautical problems, particularly those related to aircraft guidance, navigation, and control; meteorological hazards; human factors. • Employ state-of-the-art computational, experimental, and communication tools to advance the state-of-the-art of air transportation. • Communicate research results to government agencies and the aeronautical community on a regular and frequent basis. • Conduct "lean," cost-effective research by focusing on the fundamentals. • Minimize unnecessary costs by employing a "flat" research organizational structure. • Insure close, detailed, and continuing collaboration among university and government researchers. • Provide a unique "high-bandwidth" channel for NASA-FAA-University cooperation. URL http://www.ohio.edu/
The John A. Volpe National Transportation Systems Center (Volpe Center)	The Volpe Center, located in Cambridge, Massachusetts, is an innovative, entrepreneurial Federal Government organization whose principal role is to serve as a national center of transportation and logistics expertise. As such, it provides research, analytic, management, and engineering support to the U.S. Department of Transportation (DOT), other Federal Agencies, state and local governments, and potentially to other public authorities, private organizations, and foreign countries. Unlike other Federal organizations, the Volpe Center—which is part of DOT's Research and Special Programs Administration (RSPA) - is not funded directly in the Federal budget. Instead, it is market-driven by client agencies that fund the Center to address specific problems. URL http://www.volpe.dot.gov/

Appendix A: Best Practices

Best practices are fundamental principles that foster sound system prototype evaluation programs.

A.1 Early Involvement of the Prototype Team. Involve test (ATQ) and site personnel when defining the test or data collection strategy and increase coordination as development proceeds. ATQ shall be involved in all aspects of test planning and test strategy development. Field sector and air traffic managers shall concur with the key site selection and with the demands that the system prototype may place on the field site.

A.2 Use the WJHTC for System Prototype Testing. The WJHTC has superb test and simulation facilities, experienced test personnel, and a corporate memory of FAA system prototype testing. Test at WJHTC instead of at the developer's facilities when realistic operational environments are critical to the test. Beginning operational tests at WJHTC will minimize test disruptions to field site operations.

A.3 Early Risk Identification/Mitigation. The earlier in the system prototype life cycle problems are discovered the easier they are to correct, the lower the cost to correct, the smaller the schedule impact, and the least disruption to the field facility.

A.4 Coordination. System prototype programs are usually extremely complex do to their nature of exploring the unknown. Program success is dependent on coordination, even when the PEP documents are perfectly prepared.

A.5 Contractor/FAA Relationships. The relationship between FAA and contractor personnel shall be cooperative and goal oriented rather than adversarial. Data collection and testing may be adversely affected if FAA goals and contractor goals are significantly different.

A.6 Use Software Inspections and Automated Tools to Reduce System Prototype Evaluation Costs. Most software defects are found through software inspection. In addition to eliminating some repetitive manual tasks, tools can promote effective dynamic analysis by guiding the selection of system prototype evaluation data and monitoring test execution.

A.7 System Prototype Evaluation and Testing. For system prototypes to be successful, planning must start early in the concept phase. Mitigate differences through coordination, define roles and responsibilities, and write the requirements broad enough to cover all participants needs, and use similar evaluation and testing strategies when possible.

A.8 Dry Runs. Successful system prototype programs have significantly benefited from the performance of "dry runs" prior to formal placement in operational facilities for evaluation and testing

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